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ABSTRACT

Assumptions of strong, causal relations between cognition, language, and affection are often made in general and in bilingualism in particular. This paper presents first a set of hypotheses concerning the relation between affection and language in bilingualism. One subset is concerned with language learning, language maintenance, and mental health in migrant children, another with the critical period theory for language learning. A second set of assumptions is concerned with the relation between affection and cognition in general. A third set of hypotheses considers the relationship between language and cognition. Research and statements regarding the three sets are reviewed. The actual relationships are studied by means of canonical correlations, and compared with averaged simple correlations. No systematic correlations between language and emotion, and cognition and emotion could be found. However, the associations between language and non-verbal intelligence, reading and intelligence, and language and reading were found to be substantial. The results agreed with recent neuropsychological, endocrinologic, and perceptual research. Contains 88 references. (Author/LB)

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The relation between language, affection, and cognition in bilingualism

Quantitative assessments of the interrelationships

LARS HENRIC EKSTRAND

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THE RELATION BETWEEN LANGUAGE, AFFECTION, AND COGNITION IN BILINGUALISM

Quantitative assessments of the interrelationships

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Assumptions of strong, causal relations between cognition, language and affection are often made, in bilingualism and in general. A first set of hypotheses concerns the relation between affection and language in bilingualism. One subset is concerned with language learning, language maintenance, and mental health in migrant children, another with the critical period theory for language learning. A second set of assumptions is concerned with the relation between affection and cognition in general. A third set of hypotheses is concerned with the relationship between language and cognition. Research and statements regarding the three sets are reviewed. The actual relations are studied by means of canonical correlations, and compared with averaged simple correlations. No systematic correlations between language and emotion, and cognition and emotion could be found, nor in an extensive literature review. On the other hand, the associations between language and non-verbal intelligence, reading and intelligence, and language and reading are substantial. The results are found to agree with recent neuropsychological, endocrinologic and perceptual research.

Keywords: Acculturation, affective development, adjustment, bilingual education, bilingualism, child development, cognitive development, cross-cultural research, emotion and cognition, emotional development, endocrinological development, immigrants, language and cognition, language development, psycholinguistics, second language learning.

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1. PROBLEM

1.1 Introduction

Assumptions about the association between (a) language and affection, (b) cognition and affection, and (c) language and cognition, are frequently expressed as if strong, causal relations exist. Often strong views on the direction of the assumed relation are voiced. This is especially true for the education of immigrant students.

The aim of this paper is (1) to review the issues; (2) to give a short review of empirical research done with quantitative methods on these problems; (3) to study quantitatively, with multivariate methods, the assumed relationships, and test some of the hypotheses advanced; (4) to relate the results to other relevant research.

In the literature, the issues are researched at two levels: the applied level, and the theoretical level. At the theoretical level, the discussion is concerned with what is primary of affection and cognition. The present paper is primarily concerned with the applied level, specifically with implications for bilingualism, minority education, and policies regarding these issues.

However, the relation between the applied and theoretical domains cannot be neglected. The theoretical discussion has obvious relevance for the discussion on language, affection and cognition in bilingualism, in serving to provide explanatory hypotheses for the applied field. Conversely, results and conclusions from applied data on bilingualism may contribute to the theoretical discussion, by supporting or rejecting one or the other position.

1.2 Assumptions at the Applied Level

The first set of applied assumptions concerns the relation between affection and language. The set may be divided into three subsets. The first two subsets are concerned with migrant children. It is often claimed that migrant children develop emotional disturbances because of language problems. According to subset 1, this is because they do not learn the host country language. According to subset 2, it is because they do not maintain the mother tongue. In both cases, social and emotional disturbances are said to be created through language deficiencies. The third subset is concerned with the critical period theory for second language learning. Emotional language blocks that appear around puberty, and last throughout life, is an essential hypothesis for explaining an assumed critical period for foreign or second language learning. The first two subsets only will be emphasized in the present paper.

A second set of applied assumptions is concerned with language and cognition, to some extent also with language and affection. It is sometimes argued that learning a new language "too early" is harmful for the total cognitive, linguistic and affective development of the child.

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1.3 Assumptions at the Theoretical Level

At the theoretical level, one discussion is concerned with the relation between affection and cognition in general, opened by Zajonc (1980) and opposed by Lazarus (1981). Zajonc argued that affection and cognition sometimes may be relatively independent. Lazarus argued that cognition always is primary to affection. The debate has since continued by both these authors, along with many others.

A second discussion is concerned with language and cognition, and whether one is dependent on the other. Some authors, such as Luria, have argued that language directs the cognitive development, and also determines the way people think. Piaget, Vygotsky and Bruner have argued the opposite.

In this section, we will first briefly examine the various positions, and then formulate some hypotheses that can be tested in a quantitative way. Such tests are important; there is actually a scarcity of quantified data on large samples, at both the applied and theoretical levels.

True, it may be said that our data at the applied level are concerned with individuals/groups, and the theoretical level with system functioning, but clearly there is a relation. If a system works in a specific way, it must be reflected on the applied level if the theory has any meaning.

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2. EXAMPLES OF ARGUMENTS UNDERLYING THE VARIOUS SETS OF ASSUMPTIONS

2.1 Language and Affection

It is generally assumed that the emotional and social adjustment in immigrant children is causally related to language proficiency in a unidirectional way, such that the degree of socio-emotional adjustment is contingent on the degree of language command. Command may be either of the first or of the second language, depending on the school of thought.

Regarding second language command, Gelinek (1974, p. 46) expresses the position clearly: "In the family group the language of the home country is spoken, but when the child wishes to communicate with the outside world, he is faced with the inability to express himself properly. Frustration and a feeling of inferiority result, frequently causing children to withdraw from experiences in the 'outside world' and refrain from establishing emotional relationships in that world. Others, however, react aggressively and in an uncontrolled manner under this pressure, which in turn leads to a rejection, from which they suffer."

Schumann (1975) states that the repertoire of problem-solving and other coping mechanisms, such as language, does often not fit into the new culture. The coping mechanisms which in the old culture are routine matters require great energy in the new culture, which condition "can produce fear, anxiety and depression" (ibid. p. 212). Language learning may prevent or cure emotional problems: "Learning the local language in order to be able to articulate problems and reorient oneself is what is required to overcome stress (ibid. p. 212). On the other hand, "culture shock and culture stress can induce a whole syndrome of rejection which diverts attention and energy from learning the second language." (ibid. p. 213).

Regarding native language command, Skutnabb-Kangas & Toukomaa (1976) and Toukomaa & Skutnabb-Kangas (1977) argue that lack of command of the native language, and not being taught with the native language as a means of instruction, causes emotional disturbances, identity crises and social problems. In addition, learning the new language too early would cause "double semilingualism" (inadequate language development in both languages) and cognitive retardation. The remedy for this would be to postpone formal teaching of the new language until grade 3, and then only "orally and with great caution".

Thus we have two contradictory and incompatible assumptions regarding language as being a causal factor in the occurrence of psycho-pathological conditions: new language deficits and native language deficits. One solution being argued is to learn the new language; another is to refrain from learning the new language.

This puts the decision maker in a very difficult position: either way he is doomed, as bilinguals are in danger of developing disturbances whatever language is dominant. The problem thus is both theoretically relevant for the fundamental question how the mind deals with the domains of affection and cognition, and also crucial for the education of immigrants and linguistic minorities all over the world. Research

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results are frequently fed directly into the often heated debate on minority education in many countries.

Ideas of the harmfulness of bilingualism are not new, but the present fear of se semilingualism seems to have surfaced in the Swedish-Finnish bilingual population in Finland around 1950. The Scandinavian ideas of the harmfulness of early bilingualism are beginning to spread to other parts of the world. The idea of postponing second language teaching for immigrant and minority children until grade 3 was proposed in Canada around 1980 (Bhatnagar, 1981). Later on, Cummins & Swain (1986) have adopted the Finnish argumentation for the primacy of the mother tongue.

2.2 Cognition and Affection

At the applied level, the possible relation between affection and cognition is rarely discussed, but there are a few exceptions, see below. In the context of migrant children, no direct connection is generally assumed between affection and cognition: language is supposed to be the causal factor, affecting both affection and cognition, positively if the mother tongue is promoted, negatively if a second language is learnt early in life.

One applied example is the recent debate on the integration of cognition and affect in the socialization of children, the "Humpty Dumpty Debate" (how to put thinking and feelings together), see e.g. Ratner & Stettner (1991) and Cole (1991).

One important piece of applied research (Bloom & Beckwith, 1989) describes how language becomes integrated with affection, in a way that coincides with the present author's theoretical position. "By the time language begins in the second year, the development of the system of emotional expression is well under way." (p. 314). Emotions involve subcortical as well as cortical regions of the brain: emotional expression and monitoring have predominantly right hemispheric specialization, whereas language is associated with left-hemispheric activity (ibid., p. 316). Their empirical verification is important, and deserves some space.

According to Bloom & Beckwith (1989), there is a competition between learning to say words and expressing emotion; 1-year-old infants who spend more time in neutral affect expression achieve certain milestones in language earlier than infants who express emotionally toned affect more frequently, because cognitive processing requires skills that are specialized for the different cerebral hemispheres.

Deriving certain hypotheses from the competition theory, infants in the single-word age (13 months) were followed through the "vocabulary spurt" at 19 months. Words concurred in time with expressions of affect, indicating that they learnt words to express what their feelings were about, but not using emotion terms. I. e., the infants cannot tell what they are feeling, but rely on facial and postural displays of affect. The peak in affect expression comes after having said the word. Language learning seemed to have a stabilizing effect on emotionality. Language does not replace affect expression. Both emotional expressions and language develop into more complex patterns, with some further integration.

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At the theoretical level, the discussion on cognition and affection is all the more prominent. Zajonc (1980, 1984) argued that the association is weak, and that the two domains are fairly independent: "affect and cognition are separate and partially independent systems and...although ordinarily function conjointly, affect could be generated without a prior cognitive process." (1984:117). He supported this position with empirical data on affective judgments, and neuroscientific considerations. He was opposed by Lazarus (1981, 1982, 1984, 1991)) who claimed, among other things, that perception of a stimulus or situation must precede any affective response: "Cognitive appraisal (of meaning or significance) underlies and is an integral feature of all emotional states." (1982:1021). He supported his position with rather drastic experiments on direct emotional psychophysiological and psychological reactions. The Zajonc (1980) paper released a somewhat heated debate (Birnbaum, 1981; Zajonc, 1981; Slife, 1981; Baars, 1981).

The Zajonc-Lazarus debate left some questions open. Neither combatant paid enough attention to defining and examining the domains of emotions and cognition. Are sensory processes part of cognition? Are perceptual processes part of cognition? Should the concept of cognition only include what is usually called "higher processes": thinking, language, etc.? Furthermore, both combatants discussed on principle, but from very different types of data.

More recently, the research on emotions and cognition has rocketed, no doubt stimulated by the Zajonc-Lazarus exchange. The major school of thought is the cognitivist approach, i. e. it is taken for granted that cognition incites and structures emotions. In other words, Lazarus' position seems to be prevailing.

Among authors writing from a cognitivist perspective are Ortony et al. (1988). They list 4 types of "evidence for theories of emotion", viz. (1) Language; (2) Self reports; (3) Behavior; (4) Physiological reactions. The authors attach more weight to (1) and (2), whereas (3) is deliberately "played down" because "it is not often that these behaviors actually constitute an emotion" (p. 10). No. (4) is disregarded because it does "throw relatively little light on the cognitive component of emotion" (p. 12). The whole goal is "to present an approach to the study of emotion that explains how people's perception of the world - their construals - cause them to experience emotions. We consider two questions to be central to this enterprise. The first is 'What is the cognitive structure of the emotional system as a whole?' The second main question is 'What is the cognitive structure of individual emotions?'" (p.12).

The argumentation poses interesting questions. Are (1) and (2) accepted because they "constitute emotions" (at variance with 3)? Should all evidence that "throws relatively little light on the cognitive component of emotion" be disregarded? Finally, by the nature of theory, there cannot be any evidence for a theory, only evidence on which to base a theory.

Another cognitivist is Frijda (1988, p. 351) who attempts to redefine well-known emotions, e. g.: "Joy, for instance, is

a sense of pleasure plus the urge toward exuberance and contact-seeking. Anger is a sense of displeasure plus the urge to do some of the things that remove or harm an agent." These attempts do not seem completely convincing for clarifying what these feelings are. It is hard to imagine a play-wright giving stage instructions of this kind, or an actor attempting to represent them.

Presupposing primacy of cognition as in the cognitivist approach, seems bold. What if there, in fact, are two, relatively unrelated behavioral domains, each perhaps processed by different brain structures? Scientifically, it would seem safer first to define and explore each domain, then study to which extent, and how, they might be related, and only then study to what extent one structures the other.

Although the cognitivists seem to be a majority at present, there are opponents. Griffiths (1989) points out that the cognitivist approach involves (a) a claim that the occurrence of "propositional attitudes", i. e. evaluative judgments, is essential to the occurrence of emotions; (b) a claim that the identity of any emotional state depends on the propositional attitude. He observes that psychoevolutionary theories regard many emotional responses as innate and pancultural, whereas constructionist theories view certain other emotions as culture-specific patterns of learnt behavior. Neither is amenable to analysis with the traditional armor of propositional attitudes.

Griffiths sees the following 6 problems in the cognitivist approach. (1) objectless, hence contentless emotions, such as depression, elation and anxiety, are simply denied, in an attempt to protect the central theses of cognitivism; (2) reflex emotions, such as fear of spiders, snakes, or earth worms cannot depend on evaluative judgments, no-one would entertain a propositional attitude that earth worms are dangerous, thus these emotions are also rejected by cognitivists as self deceit; (3) the cognitivist approach of identifying emotions with evaluative judgments gives far too many emotions, and besides many evaluative judgments do not contain any emotion at all, e. g. those of an apple sorter; (4) cognitivists claim that specific judgments give specific emotions, but this is not true: "A is a good pianist" may give rise to admiration, envy or possibly other emotions; (5) the cognitive theory neglects physiological aspects of emotions; (6) cognitivists claim that we cannot have pure emotions regarding imagined objects or events, but only imagine that we have them, and if we do have strong emotions, we have confused fantasy and reality. This defense is a major weak point in the cognitivist approach.

In connection with the centennial celebration of W. James's The Principles of Psychology, a number of papers have appeared, providing alternatives to the fundamentalist cognitivist approaches (Bryon, 1990; Evans, 1990; Natsoulas, 1989/90, 1990; Taylor, 1990; and others). For instance, Blascovich (1990) has proposed an expanded Jamesian arousal-cognition model of arousal-based behavior, based on recent advances in psychophysiological research, and focused on individual differences in arousal. Natsoulas (1990) argues for a pluralistic approach to the nature of feelings.

2.3 Language and Thought

There is a long controversy over whether language or cognition is leading the intellectual development, and which affects the other most. There are at least three major examples of scientific exchange over this issue.

The most recent exchange is at the applied level, viz. the (originally) Finnish idea that the mother tongue leads the cognitive, social and emotional development. If the mother tongue is damaged, e. g. by learning a second language too early, before grade 3, the total development of the child will be damaged (Skutnabb-Kangas & Toukomaa, 1976 pp. 7, 25-26, 69-70, 82-83, 84-85, etc.). These ideas have later been taken up by Cummins & Swain (1986). They are strangely void of connection with the two other exchanges (see below). In reality, the Finnish idea has the roots in 19th century nationalism that in turn sprung from the periods of Swedish and Russian superiority over Finland (Ekstrand, 1980c).

At the theoretical level, a number of early linguists, such as von Humboldt, Lee Whorf, Sapir and others have argued that language determines the perception of the world. Wilhelm von Humboldt argued that every language has its own "world view" (Weltansicht), which exerts a profound influence on the thinking and feelings of humans. Later on Sapir (1921) regarded language as a "guide of social reality", i.e. language determines and specifies our perception through the built-in expectations that pervade the field of experience. One of his students, B. L. Whorf, launched similar ideas of a world view in every language (1956). The von Humboldt-Sapir-Whorf hypothesis has been refuted in its strong form (Hoijer, 1954; Gipper, 1972; Oksaar, 1977). Some authors, e. g. Linell (1978) accept the hypothesis in a weak form, i. e. language may in certain situations and under certain circumstances occasionally exert an influence on the perception and structuring of the outer world.

Luria (e.g. 1959, 1961) strongly claimed the primacy of language for cognitive development, arguing that language "expands the child's experiences, provides it with new behaviors and new ways of organizing mental activities" (1961, p. 2). Luria later changed his opinion (1975), declaring that he now fully shared the view of Piaget, Bruner and others. Experimental child psychology (e.g. Bruner, 1976, 1980; Ninio & Bruner, 1978; Ratner & Bruner, 1978) as well as research on pre-verbal communication (Bullowa, 1979) have produced results that seem to turn Luria's statement upside down: The child's experiences, new behaviors and new ways of organizing mental activities are prerequisites for the development of language.

Vygotsky has often erroneously been alleged to share Luria's view, e. g. by Bain (1975), but it is easy to show that Vygotsky takes a position close to Piaget. The following quotations from Vygotsky (1962) make it perfectly clear that he in essence shared, and preceded, Piaget's views: "The history of language clearly shows that complex thinking with all its peculiarities is the very foundation of linguistic development" (p. 72); "Let us now summarize the relevant data yielded by recent studies of children. We find that in the child, too, the roots and the developmental course of the intellect differ from those of speech - that initially thought

is non-verbal and speech non-intellectual" (p. 49); "A word devoid of thought is a dead thing, and a thought unembodied in words remains a shadow" (p. 153); "In the beginning was the deed. The word was not in the beginning - action was there first: it is the end of development, crowning the deed" (p. 153).

The last majestic paragraph might just as well have been written by Piaget. In an postscript (1962) Piaget observes how much they had in common, and regrets that they never could meet.

However, the possible association between language and cognition has never, as far as I know, been studied quantitatively with correlational methods on large samples.

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3. HYPOTHESES

In the present study, there are four domains of measurements (for details, see below, sect. 5, "Methodology"). A set of 6 Language tests, and a set of Oral Reading tests represent "Language". A set of measurements of School Adjustment, Social Adjustment, Emotional Adjustment, and Language Adjustment represents "Affection". A set of 3 tests of Non-verbal Intelligence represent "Cognition". On the basis of the presented research review, the following set of hypotheses was formulated at the applied level, in operational terms of the obtained measurements, to be tested by the method of canonical correlations.

3.1 Set of Hypotheses 1. Language & Affection, Reading and Affection

1.1 H:0 There is no, or at the most a very slight, systematic correlation between the domains of Language/Reading and Affection.

1.2 H:1 There is a moderate to strong, positive correlation, so that better Language/Reading means better Emotional Adjustment, and vice versa.

1.3 H:2 There is a negative correlation, so that better Language/Reading means worse Emotional Adjustment, and vice versa.

1.4 H:3 If there is a correlation, data and facts will indicate a causal relationship.

1.5 H:4 If there is a correlation, data and facts will indidicate that there is no causal relationship.

3.2 Set of Hypotheses 2. Cognition & Affection.

2.1 H:0 There is no, or at the most a very slight, correlation between the domains of Cognition and Affection.

2.2 H:1 There is a moderate to strong, positive correlation, so that stronger Cognition means stronger Affection, and vice versa.

2.3 H:2 There is a negative correlation, so that stronger Cognition means weaker Affection, and vice versa.

2.4 H:3 If there is a correlation, data and facts will indicate a causal relationship.

2.5 H:4 If there is a correlation, data and facts will indicate that there is no causal relationship.

3.3 Set of Hypotheses 3. Cognition & Language

3.1 H:0 There is no, or at the most a very slight, systematic correlation between the domains of Language and Cognition.

3.2 H:1 There is a moderate to strong, positive correlation, so that stronger Cognition means stronger Language, and vice versa.

3.3 H:2 There is a negative correlation, so that stronger Cognition means weaker Language performance, and vice versa.

3.4 H:3 If there is a correlation, data and facts will indicate a causal relationship.

3.5 H:4 If there is a correlation, data and facts will indicate that there is no causal relationship.

At the theoretical level, some comments to the following questions might obtain support in the present paper:

1. Is cognition primary?
2. Are emotions primary?
3. Is there a strong relationship/overlapping between cognition and emotions?
4. Is there a relative or even absolute independence between cognition and emotions?
5. Does cognition structure emotions? If so, how?
6. Do emotions structure cognition? If so, how?

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4. SOME PREVIOUS RESEARCH

4.1 Studies of the Relation between Affection and Language

We will first look upon correlation studies of the relationship between the affective and the language domains. There are several such studies. We will then review som experimental evidence.

Lambert et al. (1963) found very low correlations between L 2 achievement and some affective measurements, such as feelings towards the French people, language and culture, as well as measurement of social adjustment, such as social dissatisfaction, normlessness, alienation, ethnocentrism and authoritarianism. Gardner & Lambert (1959) and Gardner & Lambert (1972) also found low correlations between similar measurements. Instead of emphasizing this rather surprising lack of association, the authors draw the opposite conclusion, i.e. argue the importance of attitudes, motivation, etc. for L 2 acquisition. These conclusions, however, seem to be the result of influence from the social desirability of such associations, rather than of an unbiased evaluation of the actual results. Bhatnagar (1970) studying immigrant students found correlations between five measures of adjustment (social acceptability, personal satisfaction, anxiety, objectivity of self concept, and a composite score) and academic achievement ranging from .09 - .45. Correlations with spoken English ranged from -.28-.23, with IQ from .18-.48.

Haynes (1971) also found low correlations between social adjustment and two measures of vocabulary, viz. .03 and .07. Between social adjustment and four measures of language and arithmetic ability, correlations ranged from -.03 to .13, with an average coefficient of .08. Between emotional adjustment (anxiety) and vocabulary the correlations were .16 and .12 and between anxiety and the four abilities coefficients were between .12 and .20, with an average of r = .15. Ekstrand (1976) found very low correlations between second language tests among immigrant students and measures of emotional and social adjustment.

A fair amount of work has been done on attempting to relate psychodynamic concepts to language learning. In particular, Guiora and his co-workers have tried to establish the role of personality factors in language learning. The theory is, as discussed in some detail in Ekstrand (1979), that adults develop a language ego, just as children develop a body ego. This language ego sets boundaries which help to distinguish the speaker's identity from others but also may hinder the acquisition of a second language. Especially pronunciation is assumed to be hard to acquire, as the identification with one's native language is assumed to be quite strong.

In some interesting experiments (Guiora et al., 1972; Schumann et al., 1978) the psychodynamically oriented workers have demonstrated that L 2 pronunciation improves after intake of alcohol or under hypnosis. These results are interpreted as demonstrating that the permeability of ego boundaries increases (i.e. that the resistance diminishes) when inhibitions become weakened. There is however, a weak link between the

experimental condition and the theoretical explanation. Furthermore, the data do not permit an assessment of the strength of the possible association between the affective variables and pronunciation. Much of the work in this area is purely theoretical, as discussed in Ekstrand (1979). In summary, this approach is not of much help in this context.

Cziko & Lambert (1976) expected attitudes towards a second language and the associated culture and people to improve after closer contact. Some English-Canadian and French-Canadian students exchanged schools for some time. Depressingly enough, scores on 11 different affective instruments tended to decrease after the experience in comparison to scores beforehand. This is, however, a phenomenon that is rule rather than exception.

Attitudes towards a language, or the groups who speak it, or the culture(s) where it is spoken have often been claimed to be of the utmost importance for language acquisition. Skutnabb-Kangas & Toukomaa (1976) argue that if a group, such as an immigrant or minority group, is in a minority position, negative attitudes towards the minority from the majority, or lack of self-confidence in the minority group, may affect acquisition of the majority language. The importance of attitudes is also stressed by Lambert et al. (1963), Gardner & Lambert (1959), Gardner & Lambert (1972), Burstall (1975), and others.

However, actual correlations between attitude measures and achievement tend to be rather low. This is true not only for language acquisition, but also for the acquisition of arithmetic skills, or skills in any other school subject. Furthermore, this is also the case with many motivational measures, another affectively loaded variable which has been claimed to be of great importance in learning. Before reviewing actual results, we may note that there is disagreement upon what attitudes and motivation really are. Generally speaking, both seem to indicate a prediction of action or learning, based in part on an affective component, in part on a cognitive component (intellectual considerations), see Bhatnagar (1970) for detailed discussion.

Lambert et al.. (1963) tried to separate the emotional component (feelings towards a language, etc.), calling it integrative motivation, from the cognitive component of motivation, calling the later instrumental motivation, as it often contains intellectual considerations of the possible usefulness, etc., of learning a language. Lambert et al. (ibid.) obtained a correlation between attitude and achievement of .23; and between integrative/instrumental motivation and language achievement of .25 (in favor of integrative motivation) in a group of American students taking an elementary summer course in French. The corresponding correlations in an advanced group of students were even negative, although as low as to be insignificant. Gardner & lambert (1959) obtained a correlation attitude-achievement of .10 only, a correlation integrative/instrumental motivation - language achievement of .34, and motivation intensity - language achievement of .40. The motivational measure contained items such as "amount of home work put down", "frequency of taking opportu-

nities to speak and read French", and other items which really measure time and activities spent on learning, rather than feelings or intentions. Gardner & Lambert (1972) obtained a large number of correlations between attitudinal and motivational measures on the one hand, and language achievement measures on the other, nearly all coefficients being under .40.

Lewis & Massad (1975) give correlations for attitudes towards English in ten countries (Perceived Utility of English; English Activities Outside School; Interest In English) and achievement in English. The mean correlation over all countries and student populations (computed by the present author from data in Lewis & Massad) are .21 for Perceived Utility, averaged for all achievement tests, .25 for English activities, and .29 for Interest. Out of total of 168 coefficients, 114 (73%) are below .30 and 129 (88%) are below .40.

As seen from the names of the IEA measures above, the attitude measures are heavily loaded with "instrumental" motivation, i.e. time spent on learning, activities used for informal language learning, or considerations of the possible usefulness of language study. In other words, the measures are heavily loaded with cognitive factors. Still, the correlations are not very high.

Carroll (1975) reports the results from another IEA study of French as a foreign language in eight countries, using almost identical measurements as the English study. Although Carroll does not report any correlations, the results of the multivariate analyses suggest that the attitudinal and motivational measures contribute similarly to the achievement variance in the French as in the English IEA study. These results, as well as those of Ekstrand (1976a) and other studies of attitudes and learning reported by Ekstrand (ibid.) suggested that weak associations between emotional measures and language learning are part of a more general pattern of weak associations between the cognitive and affective domain.

Carroll (1975) in connection with various attitude measures discusses the possible contamination with achievement variables, for instance of Perceived Ease of French (p. 220): "On the other hand, it may be a variable that is to some extent contaminated with the criterion variable, on the supposition that students are more likely to report a subject as easy if, for example, they perform well on it and get high grades in it." This opinion is also given concerning an item in the interest scale. It may well be that such a contamination is inherent in many attitudinal and motivational variables, and that, in fact, the assumed causality is reversed to that normally assumed, as suggested by the neurological considerations above.

Taft (1978) studied the relative competence in children who were bilingual in English and Russian. There was no relationship between their preferences in language usage and their competence in either English or Russian, or in the dominance of one language skill over the other (p. 7). Nor was any relationship found between competence in English or Russian and integrative or instrumental motivation (p. 8).

In summary, attitudinal and motivational measures show only slight to low correlations with language achievement. Moreover, the direction of causality is far from self-evident. Therefore, the very strong claims regarding the importance of attitudes in language learning, or second language learning being improved by improving attitudes by means of more native language learning, do not seem to have a very strong case. Reliable data as well as a sound neuro-psychological theoretical basis must be demanded from those who claim the causal importance of attitudes and motivation on the face validity only, before the claims can be further heeded.

4.2. The Relation between Affective and Cognitive Measures

The order of magnitude of correlations between affective and cognitive variables is generally very low. Svensson (1971) computed 672 coefficients between, on the one hand school adjustment and interest for spare time activities, and on the other relative achievement in school subjects in large samples of students in the Swedish elementary school. They are typically very low, more than 75% are between $\pm$ .10 and none above $\pm$ .30. Aiken (1970)has covered more than 70 studies on the relationship between attitudes towards and achievement in mathematics and finds that "measures of anxiety and attitudes towards school subjects typically have rather low correlations with measures of intellectual ability" (p. 564). Neale (1969) discusses the role of attitudes in learning mathematics and reports correlations from several studies, with the same result as the previous reference. Ekstrand (unpublished data) has found very low correlations between interest in and grades respectively test results in physics on rather large samples. In this study an experiment was done so that the teachers took action to improve the affective class-room atmosphere. In spite of obvious success, correlations did not increase on the following measures of interest and achievement.

All claims of substantial coefficients have, at control, turned out to be in reality low. We may regard it as a law of nature that correlations between cognitive measures (to which language in the broad sense belongs) and affective measures are pervasively low.

4.3 The Relation between Language and Cognition

Only a few examples of studies giving the order of magnitude will be reviewed here. The selection is such that measures of intelligence have been correlated with measures of L 2 learning. The language variables have usually comprised listening and reading comprehension, pronunciation, and sometimes writing tests. The data have been collected in Table 1.

Table 1. The association between intelligence and second language learning in primary and secondary school students.

Intelligence measure	No. of cases	Students' national.	Target language	Author	Publ. Year	% variance in common
Thurstone (R factor)	300 - 1,800	Mixed immigr.	Swedish	Ekstrand	1977	5 - 21
Verbal	1,168	Swedish	German	Löfgren	1972	.2 - 20
Genera	192	Swedish	English	Ekstrand	1964	6 - 16
General	96	American	French	Gardner & Lambert	1972	.1 - 16
Thurstone (N factor)	300 - 1,800	Mixed immigr.	Swedish	Ekstrand	1977	2 - 12
R factor	1,168	Swedish	German	Löfgren	1972	0 - 10
Thurstone (S factor)	300 - 1,800	Mixed immigr.	Swedish	Ekstrand	1977	.1 - 7

It is fairly clear from the collection of studies that the association varies with type of language variable and type of intelligence assessed. It is also clear that the association is moderate, at best. In other words, whatever causality there may be cannot be complete. Furthermore, it may work both ways, not in only one direction as is often claimed.

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5. METHOD

5.1 Description of Data

For the present study, a data bank on immigrant students in Sweden was used. A number of reports using this data bank have previously been published. The data comprise 2,188 students in grades 1-9 of 36 nationalities. A questionnaire for the 2,188 students had been filled in by 852 teachers of Swedish as a second language. The teachers had been asked to perform a number of ratings as well as a number of tests of Swedish. There is a varying return of data for each variable. Accounts of representativity, return of data, missing data analyses, etc. are given in Ekstrand 1976a, 1976b, 1979 and 1980. Instructions were given in such a way that test performance would not be contingent on students' ability to understand instructions.

There are four sets of data variables: (1) language variables; (2) adjustment variables; (3) oral reading test; (4) non-verbal intelligence tests.

A number of language tests were constructed for the study, viz. Listening Comprehension (LC), Reading Comprehension (RC), Dictation (Dict), Free Written Production (FWP), Pronunciation (Pron), Free Oral Production (FOP). The latter two were recorded on sound tape and then rated. Because of these troublesome procedures, they have a smaller number of individuals than in the other variables. These form a domain of Language Proficiency (Lang.), with a Pearson intercorrelation of r = .57.

The teachers had been asked to rate the students with respect to a) Progress in School; b) Social adjustment; c) Emotional adjustment; Progress in Swedish. As it happens, these variables intercorrelate quite substantially; the average Pearson correlation is .52. In other words, the teachers have not always been able to separate emotional from cognitive observations. A quiet student may be thought to be shy or non-proficient in Swedish, or both. Thus this domain is highly affectively loaded and is regarded as a domain of Affective Adjustment (Affect.).

Three Oral Reading Tests (ORT) were intended to measure skills of reading text. No measure of understanding was included. Each test consists of (a) syllables; (b) words; and (c) sentences. For each test, three mea- sures were obtained, viz. (1) time used (up to 2 minutes); (2) number of words read; and (3) number of errors. The variables intercorrelate .75 on the average, and form a dimension of Reading Ability (Read).

Oral Reading, has been regarded and treated as a separate domain rather than being included in the language domain. Firstly, reading skill is somewhat different from other language variables. It strongly involves (a) visual perception; (b) technical skill of decoding letters; (c) a reading speed dimension; (d) the ability to read aloud. Thus, the present tests involves mainly motor production, but less of cognitive production. Because of the technical content, and the tasks of

reading single, unrelated syllables and words with a low content of meaning, it was uncertain how this domain would behave when canonical correlations were computed. Secondly, it is of interest to see how this type of measurement correlates with the language tests proper. Thirdly, it is of interest to compare two different language domains with the affective domain to examine the consistency of the relation.

Finally, three group tests of non-verbal intelligence were administered for students in grades 4-9. They consist of tests of the Swedish DBA series, built on Thurstone's tests of Primary Mental Abilities. The DBA 4 belongs to Thurstone factor R (Reasoning), DBA 7 to factor S (Spatial ability) and DBA 8 to factor N (Numerical ability). These tests intercorrelate .33 on the average and form a domain of Nonverbal Intelligence (Intell.).

5.2 Statistical Treatment

Intercorrelations between variables within domains and between domains give a fairly good picture of the average correlation and the dispersion of coefficients. This technique, however, does not give the whole picture, and does not extract all the information. In order to facilitate comparisons of the relations between domains - which is our primary interest - canonical correlations were computed.

The canonical correlation is the maximum correlation between linear functions of two sets of variables measured on the same subjects (Cooley & Lohnes, 1966, p. 35). Several linear combinations are often possible. For every new pair of canonical variates, the pair of functions are determined so as to maximize the correlation, subject to the restriction that they must be uncorrelated with the first pair of components.

In addition, it is desirable to look at the structure of the sets of variables, which is done with principal component analysis, or factor analysis for short. Computer routines give the factor structures as well as the canonical correlations.

A useful statistic is the redundancy for a set, given the other. The technical explanation is given in Cooley & Lohnes, 1977, p. 170. Briefly expressed, the redundancy is the amount of variance that is explained by one set in addition to the variance already explained by the other set. In other words, if one set contributes considerably more than the other, this is shown by the redundancy.

The canonical correlation (Rc) seems to be the technique that comes closest to answering our primary research questions, cf. section 3 above. These basic questions are asked for various combinations of the different domains. In other words, both multiple criteria and multiple predictors are tested in different combinations. Conventionally, one speaks of the left and right set of variables, but it is irrelevant which is considered predictor and which is considered criterion.

A characteristic of the multiple approach is that the correlation between two domains will increase when it is maximized in comparison to simple correlations. Thus, an association may appear, although domains seem unrelated when compared variable for variable. The seemingly low associations obtained previously on these data (Ekstrand, 1976a, b) may appear in a somewhat new light if there is at least one significant way in which the two domains are related. Chi^2 tests are used to reveal how many of the functions allow statistical interpretation. The computer routines and the statistical basis were all taken from Cooley & Lohnes, 1966 (which in this case does not differ from the more recent edition of 1977).

As there is an amount of missing data in many individuals and variables, and data matrices must be full to allow computation, missing data have to be filled in. Some studies indicate that as much as 20% completed data may still give a valid result in comparison to genuine data. In this study we have, in some cases, played with different demands on data completeness, one more severe demand and one more lenient. These are shown under the heading "statistical demands". There are many ways to complete data. One way is to insert the mean of the variable. We have chosen to make a regression estimate based on the values in the variables where the individuals have genuine data.

6. RESULTS

6.1 The Affective Domain vs. the Language Domain

In Table 2, the canonical correlations for Language by Adjustment are given, with the lesser statistical demands. There are two significant ways in which the two domains are related. In both cases, however, the Rc is very low, .31 and .14, as compared to an average Pearson r of .19. Thus, the Rc technique confirms previous analyses based on simple and averaged Pearson correlations. There is no substantial, systematic relationship between Language and Affection.

The variables of the two domains are shown in Table 3. In Table 3, the factor loadings for the variables of each set, the total variance extracted from each set, and the redundancy for each set are given..lsl

Table 2. The language by adjustment domains, lesser statistical demands

Statistical demands: Variables 1-4 n * 3, 5, 6 n * 1, 19-22 n * 2 — N = 802

Canonical R (Rc)	% variance in common between sets	X2	df	p	Roots removed
.31	9.5	104.44	24	p<.01	0
.14	1.9	23.31	15	p<.05	1
.09	.9	10.22	8	-	2

These demands mean that individuals must have genuine data in at least 3 variables if they belong to variable 1-4, in 1 variable if they belong to variables 5-6, and in 2 variables if they belong to variables 19-22. The demands are considered depending on the total amount of individuals on each variable. With these demands, total N becomes 802, i.e. no individual may lack data in more than 4 out of 10 variables.

The factor structure reveals that the variables of each set are strongly associated with the set as a whole. As indicated by the redundancy values, both sets contribute with about the same amount of unique variance, given the variance of the other set. Both these amounts are very low.

In Table 5 (see Appendix), the canonical correlations are given with the harsher statistical demands. In Table 6, the corresponding factor loadings, amount of variance and redundancies are given. Redundancies are similar, about 10%. The factor structures are very similar to those in Table 3. As appears from Table 4, the Rc is .41 with the harsher demands on missing data.

Table 3. Factor structures for left and right sets for the Language by Adjustment domains (first canonical factor only), total variance extracted and redundancy for each set, given the other. Lenient demands on data completeness.

Left set		Right set	
Variables	Factor loading		Factor loading
5. Listening comp.	.55	.1. Progress in sch.	.75
6. Reading compreh.	.71	.2. Social adjustmen..	.52
19. Dictation	.73	.3. Emotional adjust..	.50
20. Free written prod	.93	.4. Progress in Swed..	.95
21. Pronunciation	.49		
22. Free oral produc.	.48		
Total var. extracted from left set	82%	Tot. var. extracted from right s..	100%
Total redundancy for left set	4.7%	Tot. redundancy for right set	5.2%

With the first, more lenient demand on completeness of the data matrix, we have a reasonably large N of 802 cases. Assuming that the missing cases are random, as our investigations seem to indicate (Ekstrand 1976a, b; 1980), this sample should be representative for the total group. There are two significant ways in which the two domains are related. Notably, the Rc is low in both cases. Considering that the Rc will always be higher than the r between the two domains, .31 is not very high. The r, matrix by matrix, was .19. An Rc of about .30 or less is regarded as trivial by Cooley & Lohnes (1966). The second Rc of .14 is clearly trivial.

The very slight relationship that seems to exist between the socio-emotional adjustment of immigrant children and language learning is mainly explained by two variables in the adjustment domain being more academic in nature, viz. "Progress in school" (r with language .20) and "Progress in Swedish" (.26). The variables "Social adjustment" and "Emotional adjustment" correlate only .13 and .17 with language variables, and have also somewhat lower factor loadings. Thus, the association may be explained by "cognitive contamination", i.e. it is spurious.

With the more severe demand, N becomes drastically reduced. Only one Rc is now significant, but this is somewhat higher, .41, explaining almost twice the amount of variance. Still, the relationship is slight. The conclusions still seem to hold true. Which estimate of the Rc is the better is difficult to say. With the harsher demand, we have a data matrix out of which some cases have been completed in 30% of the variables at the most, but with a comparatively small N. This sample may not be representative for the total group. On the other hand, we have a fairly large sample, but in which

some cases may have been completed by estimated data up to 4 out of 10 of the variables. However, the difference between the two estimates is not so big as to worry us. Rather, it is small enough to convince us that both estimates yield similar conclusions.

6.2 A Summary of Correlations and Factor Loadings

Henceforth, the full tables will not be presented in the text. In order to make the text more legible, only a minimum of statistical data will be presented. The full tables are given in the Appendix, to which the reader is referred for the complete information.

The most important statistics are summarized in Table 4, giving the canonical correlations between domains, along with the averaged simple product moment correlations, given in Ekstrand (1976a, b) for comparison.

Table 4. A summary of canonical correlations and averaged Pearson correlations between domains of variables. Figures within brackets mean harsher demands on missing data.

Domains (sets of variables)	Canonical $\bar{R}$	r
Language by Adjustment	.31 (.41)	.19
Oral Reading by Adjustment	.25	.12
Nonv. Intell. by Adjustment	.24	.11
Reading by Language	.78	.38
Reading by Intelligence	.46	.18
Language by Intelligence	.69 (.56)	.26

The Rc for Oral Reading by Adjustment is shown in Table 7 and the factor structures in Table 8. Only one type of statistical demand was used. Average intercorrelations (Ekstrand, 1976a, b) are for the six Language tests .57, for the Adjustment measures .52, for Non-Verbal Intelligence .33, and for Oral Reading .75. The intercorrelation within the Adjustment domain of course reflects the emotional contamination of the academic variables and the cognitive contamination of the socio-emotional variables.

For Language, factor loadings are around .80 for Free Written Production, Dictation and Reading Comprehension, around .60 for Listening Comprehension, and around .50 for Pronunciation and Free Oral Production. For Adjustment, loadings are around .90 for Progress in Swedish, around .80 for Progress in School, around .55 for Social Adjustment, and around .40 for Emotional Adjustment. For N-V Intelligence loadings are around .90 for the Spatial test, and around .70 for the Reasoning and Numerical tests. For the Oral Reading tests, loadings vary from .61 -.86 for the three Errors measurements, .39 - .58 for Time, and .28 - .52 for Words.

6.3. A discussion of Reading and Cognition by Adjustment

In the Oral Reading tests, the RLS 1 is reading out syllables, RLS 2 is reading out words, and RLS 3 is reading out sentences. We may assume that reading comprehension enters the three tests to an increasing although limited degree.

There is only one significant Rc of .25 between the Oral Reading and Adjustment domains, confirming an average r of .12. Again, the over-all association for the best possible combination is very slight, i.e. there is hardly any overlap between the two domains. This confirms our previous conclusions.

The negative factors in the reading domain indicate the fact that the better readers use less time and make fewer errors, while they in the given time limit read more words. The factor loadings indicate a fair association with each set.

The Rc for Non-Verbal Intelligence by Adjustment is .24, i.e. of the same order of magnitude as Language by Adjustment, being a slight increase from r = .11. The factor structure is given in Table 10 in the Appendix. Redundancies for the two domains are small and of similar size. Thus, there seems to be no over-all relation between non-verbal intelligence and adjustment. Hence, the conclusion from the previous study (Ekstrand, 1976a) is confirmed.

This also confirms our previously contended view that the low association is not only concerned with language and affection, but with the cognitive domain on the whole (Ekstrand, 1976a, 1978a). Here we have examined two language domains and one cognitive domain. The language tests were carefully constructed so as to include tests of production, not merely tests of passive knowledge, which is the most common type. Hence, we may have some confidence in our conclusions.

6.4 The Reading by Language, and Language by Intelligence Domains

There are three significant ways in which the two domains are related. The first Rc is fairly high, .78, explaining about 61% of the variance common to the two test domains. The other two significant Rc.s are .31 and .29. The previously obtained average correlation was .38. This is an example how a slight correlation may be dramatically increased with the multivariate technique. The full data for the Oral Reading by the Language tests are shown in Table 11, the factor structures in Table 12 in the Appendix. The direction of causality is probably both ways: in half of the language tests, reading ability is necessary (RC, Dict, FWP). Also, as mentioned above, in the oral reading performance, particularly in RLS 3, a certain degree of semantic skill is necessary. The factor loadings show a high degree of association between the variables and their respective domain.

Oral Reading and Nonverbal Intelligence are related in one significant way only. The Rc of .46 indicates that there is another cognitive component besides language in Oral Reading.

Factor loadings are fair. The Nonverbal Intelligence tests do not presuppose knowledge in reading. Instructions were given so as not to depend on verbal skills. Of course, the N factor test requires knowing the figures, being able to make the computations and to write down the answers. Such skills are in practice coupled to reading, as they are both learnt in school about simultaneously. Also, there is a distinct spatial-perceptual component in the intelligence tests, which also most certainly operates in reading. The association is definite, but not strong. Redundancies are small, 6% for reading and 12% for intelligence, indicating that intelligence contributes more to reading than vice versa. Full data are given in Tables 13 and 14.

The Language by Intelligence association yields one statistically significant, quite substantial Rc = .69. Full data are given in Tables 14 and 15 in the Appendix. Factor loadings are high or fair, with the exception of the two oral tests Pronunciation and Free Oral Production which have low loadings. The redundancy for language is 19%, for intelligence 33%. It would seem that intelligence explains more of language than vice versa. However, N is very small, only 50 cases. The tape recorded tests, i.e. Free Oral Production and Pronunciation, were given to a limited sample only, and the intelligence tests were only given from grade 4. Therefore, we cannot increase that sample very much by diminishing the demand on real data in the variables.

By omitting the two recorded tests and using only the four remaining language tests, N increases from 50 to 263. The one significant Rc is .56., i. e. still a substantial association. These data are given in the Appendix, tables 17 and 18. Factor loadings are high in both sets. Redundancies now, however are similar, 19% and 16%. This is another example of the Rc being substantially higher than the average Pearson correlation matrix by matrix, which was only .26 in the 1976 report. We may conclude that there is a substantial component of nonverbal intelligence in language. The role of language in non-verbal intelligence seems less clear.

7. CONCLUSIONS AND DISCUSSION

7.1 The Relation between Language and Oral Reading

A substantial Rc of .78 (see Table 4) was obtained between the domains of Language and Oral Reading, as compared to an r of .38. This indicates that Oral Reading is less of a pure technical skill and more of a true language component than had been predicted, and can be seen as a good index of language ability. However, rather than combining the two sets of variables for the subsequent analyses, we have kept them apart in order to study the association Language - Affection with two slightly different language domains. The redundancies are small and of similar size.

7.2 The Relation between Language and Affection in Bilingualism

Low canonical correlations between Reading by Adjustment and Language by Adjustment are observed in the present study. In the cases of Affection - Language, and Affection - Reading, the difference Rc-r is slight, confirming the near lack of correlation, whereas the difference Rc-r Language - Reading is substantial. The results agree with the literature review, which strongly indicates that affective-language correlations are typically low. No instance of a substantial correlation has been found, in spite of extensive search.

On the basis of the data presented, Hypothesis 1.1, i. e. H:0 for the relation Language-Affection must be accepted: there is no, or at the most a very slight, positive correlation. This means that the alternative hypotheses 1.2 - 1.5, H:1 assuming a substantial positive correlation, H:2 assuming a substantial negative correlation, , H:3 assuming a causal relation, and H:4 assuming a correlation but no causal relation, are all rejected by the present data, as well as by data from the literature review.

If there is no or almost no statistical relationship, there cannot be any causal relationship. This means that generalizations, type "not knowing L 2 will cause emotional disturbances", or "not maintaining L 1 will cause emotional problems", or conversely, "improved L 1 (L 2) can prevent or cure emotional and social disturbances", cannot be valid. An explanation for the persistency of such generalizations will be attempted later.

The slight positive correlation that has been observed between the language and affective domains, may be explained by the substantial "cognitive contamination" among the socio-emotional measures, as "Progress in Swedish" and "Progress in school" are having the highest factor loadings in this set. The high correlation between these and the two purer social and emotional variables, is explained by our earlier observation that teachers (and probably any other persons) cannot fully separate emotional from language indicators. Thus, the near lack of correlation is all the more impressive.

In a small monograph (Ekstrand 1976a) age, sex, language

family, and nationality were controlled by applying within-group correlations on the present set of data, but the results turned out to be the same as before. The data have now been analyzed with a number of techniques, but the results remain the same. Hence, the likelihood that the results are due to some statistical artifact is low. In fact, the multivariate techniques accentuates the extremely low affective/language and affective/cognitive association. As the results are confirmed by the unanimous findings from thousand of coefficients in a vast number of reports, there seems to be no possibility that the lack of correlation is an artifact.

Looking in detail at the vast amount of measurements presented in the literature, we find a very clear tendency, that the purer the emotional measures, the lower is the correlation between affective and cognitive/language measurements. The reasons are quite obvious. As discussed in several places in section III:1 in this paper, there is a "cognitive contamination" in most measures of attitude, interest or motivation. The more of cognitive considerations of the type "it is useful to...", "I practice as often as I can...", etc., the higher the correlation turns out to be. In the Ekstrand (1976b) analysis of the data, "Emotional/Social Adjustment" had lower correlations with language and intelligence than had "School adjustment" and "Progress in Swedish".

7.3 The Interaction between Language and Affection

The lack of statistical correlation Language - Affection does not mean that there is no correspondence between cognition and affection, but that it takes another form. The correspondence must be thought of as an interaction, as different from correlation It is easy to arouse emotions verbally: I can make my wife happy, sad or angry with words, I can have a group of students mad or enthusiastic with words, and so on. However, these affective states are mostly transitory. The peak of affection might be gone in a matter of minutes, and the aftermath will be gone in a matter of days, weeks, or months at the most. The stability of cognitive variables, lasting over a number of years, often a lifetime, does hardly exist in emotions or will in any case be fluctuating. Also, an event may sometimes give rise to one type of emotion and sometimes to another, and similar events may give rise to different emotions, making generalizations difficult. Hence, no stable correlation can actually be expected.

7.4 The relation between Cognition and Affection in Bilingualism

The Rc for Non-Verbal Intelligence by Adjustment is .24 only. On basis of this, Hypothesis 2.1, i. e. H:0 for the relation Cognition-Affection, must be accepted: there is at the most a very slight, positive correlation. This means that the alternative hypotheses 2.2 - 2.5, i. e. H:1 assuming a substantial positive correlation, H:2 assuming a substantial negative correlation, H:3 assuming a causal relation, and H:4 assuming a correlation but no causal relation, are all rejected by the present data. The empirical studies reviewed broaden the

findings from the area of bilingualism to all areas of cognition and affection that have been studied. The literature review and the data presented here are unanimous: there are negligible associations between affective and cognitive data. Together with the language data, this finding constitutes an indication of the independence between purely cognitive and emotional reactions in general. The findings seem to support Zajonc's position, and weaken Lazarus' position.

7.5 Language and Cognition

In the Reading vs. Intelligence analysis, the Rc is substantially larger, .46, as compared to r = .18. For Language by Intelligence, Rc is .56 for a limited language domain giving a sample N = 263 (.69 for the full language domain giving a sample of N = 50 only) as compared to r = .26, i. e. a very substantial increase. On basis of the data presented, Hypothesis 3.1, i. e. H:0 for the relation Language-Cognition must be rejected: there is a substantial, positive correlation, supporting the alternative hypothesis 3.2, i. e. H:1. H:2 assuming a substantial negative correlation is rejected. The present data do not have the power, either to reject or confirm hypotheses H:3 assuming a causal relation, and H:4 assuming a correlation but no causal relation.

Looking at the redundancies, Intelligence contributes twice as much unique variance as Reading, 12.4% compared to 6.6%. Redundancies for Language by Intelligence are larger, the Intelligence redundancy being almost twice as large, 32.9%, as the Language redundancy of 19.1%.

In brief, these data indicate that language and intelligence has a great deal of variance in common, but that nonverbal intelligence may contribute more to language than vice versa. The data seem to support the observations of many authors, such as Lorenz and Porzig (reviewed in Ekstrand, 1978a) regarding the important contribution that nonverbal intelligence makes to language. Language is constantly using physical and spatial analogies, and seems in fact to play a major part in translating the physical world to the mind. Further, the data are not inconsistent with the Piaget and Vygotsky position that concept formation is primary to language, although the development is integrated. It does not seem to be consistent with Luria's previous position that language leads concept formation and behavior. However, this should be taken more as circumstantial than as positive evidence, as the data do not allow any far-reaching conclusions. Due caution should be exercised in interpreting the data. What the analyses do suggest is that the old discussion on language versus cognition may be approached with quantitative, multivariate techniques. There are statistical methods (path analyses) that allow causal interpretations.

7.6 Possible Explanations for the Lack of Correlation

The lack of systematic correlation between affection and language, and affection and cognition, is not as remarkable as some might believe. There are many different reasons why a

strong correlation cannot exist. Firstly, one apparent reason is the transitional nature of emotions. With the exception of a few lasting states, such as grave depression, emotions may normally last seconds, minutes, or, at the most, a few days, provided that the condition inducing the emotion still exists and exerts influence. Although there are also short-lived cognitive processes, such as insight, associations, flashes of ideas, etc., many basic cognitive elements lasts for many years, perhaps throughout life, with relatively minor modification: basic intelligence, language, academic skills such as writing, reading, arithmetics, etc.

Secondly, the same phenomenon, event, situation, person, etc. may give rise to different emotions, depending on changed circumstances: my joy over the arrival of some dear relative may turn into disappointment if the visit is delayed; a quarrel with my loved one may turn my love to anger, that again will turn to sweet love upon reconciliation when the conflict is resolved, etc.

Thirdly, differences in personality and temperament may induce very different reactions in different individuals to the same type of situation. The shy, introverted immigrant student may react with silence to the new surroundings, whereas the extroverted, expansive type will try to communicate, perhaps quite vividly, with a very limited supply of linguistic tools.

Fourth, the same event may give rise to different emotions in the same person, depending on the conditions within that person, such as status of health, fatigue, etc. Flying may be experienced as stimulating or relaxing when one is well rested, but may induce apprehensions when one is tired.

Fifth, the same event, condition, etc. may have very different emotional associations for different individuals, depending on their previous experiences. The word "mother" may have a very positive emotional loading to most persons, but may be very negative to some who have had bad or even nasty relations with their mother, lost the mother, etc.

Sixth, as discussed further in sect. 7.8, there is a relative independence of emotion and cognition. The fact that emotion and cognition are different events, processed differentially by different but coordinated brain mechanisms, is central for the issue. This means that the characteristics of cognition and emotion are so different (e. g. differences in expression, duration, degree and nature of physiological concomitants, etc.), that a high degree of correlation should not be expected. This statement will be corroborated in section 7.8.

Incidentally, the lack of correlation and all the unsystematic variation makes it very hard to believe that emotional learning blocks (cf. 1.2 above) would be such a stable variable so as to constitute the basis for a universal critical period. This discussion cannot be pursued further here.

7.7 Explaining the Confusion between Language and Emotion in the Debate on Bilingualism

Why are so many arguing that language has causal effects on emotional adjustment, and what could be the reasons for this belief? The answer seems to lie in the existence of an invisible chain of conditioning mechanisms between language and some event that originally triggered an emotional response. In childhood, a situation or event occurs, giving rise to some emotion. The emotional response becomes attached to this event. During repeated experiences of the same kind of event, language becomes also attached to the event in which an emotion is experienced, directly or because of later consequences. The situation or event will form a specific memory or concept, to which the linguistic expression as well as the emotion become attached, through the usual mechanisms of conditioned reactions, processed via the limbic brain circuits. The linguistic expression will later trigger the memory or concept that it represents, as well as the attached emotion. Superficially, it appears as if language triggers the emotion directly.

What about the affective value in words? In the examples of interaction mentioned lies the key to some mechanisms. It is not the words I utter that really affect the feelings. It is rather the concepts or situations that the words denote, and the concrete, actual consequences of them that arouse the feelings. The words are just the carriers of the message.

However, words do not contain feelings by themselves. They must acquire affective values that may be differential in several ways. Feelings are attached to words or concepts through learning, a process of conditioning. Words such as "mother", "rich", etc. may take on affective meanings according to the experiences of the individual. If the relation with the mother has been good, the word will carry positive associations and feelings, if it has been poor, it will carry negative associations and feelings.

The anatomical, and to some extent physiological, mechanisms of conditioning, and the interplay between learning, concept formation and emotions, have been analyzed in depth by Mishkin & Appenzeller (1987), as discussed later in this paper.

The implication of this is that ideas such as that language induces feelings, or that only the mother tongue can express feelings adequately, are radically false. If you learn to use emotional words in another language, they may become equally important and useful as in your first language. You will find that "caramba" or "sacre bleue" may be just as telling as "damn!" "querida" or "cherie" may be just as affectionate as "darling". It may be true that words in the mother tongue may be more efficient in arousing positive or negative feelings attached to early childhood experiences, but that only corroborates that mechanisms of conditioning or chemical/anatomical influence are involved.

There has been much arguing that infants attending day care centers or preschool institutions staffed by personnel from

the host country, will be deprived of their mother tongue development, and thus also become socially and emotionally deprived. Looking closer into this kind of situation, some salient facts emerge:

Firstly, the work pattern among immigrant parents is often more intensive than among indigeneous parents. The fathers often have more than one job, and the mothers work full time to a higher degree than indigeneous mothers. This is because immigrant parents often have more pronounced economic goals: they save to buy a future shop or a farm in the native country, or they want to bring parents, grandparents or other relatives to the new country. They also often strive to maintain a very high degree of material standard, partly because the opportunity exists in the host country, partly to assert themselves socially.

Secondly, this work pattern leads to diminished interaction with the children. Thus, poor mother tongue achievement is not primarily due to the child attending a host country institution, but to lack of linguistic interaction with the parents. The lack of interaction also affects the children's social and emotional development: they become, as it were, contact-starved. There is a host of research indicating the consequences of lack of contact, that we cannot enter upon here.

Thirdly, the parents often enter into an emigration crisis, with loss of identity and other problems, and this frequently reflects on the children (Ekstrand et al., 1981). This is not a linguistic, but an existentialistic problem. However, the incidence, as registered by Swedish social authorities, is much less among immigrant children than among their parents.

Thus, the alleged linguistic, social and emotional problems in immigrant infants may well be correctly observed (although the rate is exaggerated), but the causes are very different from what is being alleged. In other words, neither improved mother tongue development or learning a new language may as such prevent or cure emotional disturbances, or affect the social or emotional development. It is the cultural context and the social environment, as well as the cognitive concepts that the languages denote that are the effective agents. These may also be transmitted non-verbally, indicating that language may, in many situations, be dispensed of altogether. Communication is the key, not language.

7.8 The Theoretical Connection

There are several theoretical implications of the results presented in this report, but also a need for theoretical explanations. For instance, Lazarus' and the other cognitivists' position of cognition as always primary would seem to be consistent with the view of language being able to induce or cure emotional disturbances. However, as we have seen, the bulk of evidence goes against this hypothesis. This kind of direct relationship does not seem to be able to exist, but the reasons need to be further explored. The discussion will be conducted at three levels: (1) An analysis of the basic models of thinking in the debate; (2) A review of evidence for or

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against these models; (3) A description of cases where emotions in fact are primary to cognition.

The implicit models for the two schools of thinking in the debate are: (a) perception and/or cognition always comes first, followed by emotion (cognitivist view); (b) emotion may be prior to, simultaneous with, subsequent to, or relatively independent of cognition. Whereas the second model is more comprehensive and flexible, both models assume that there are only two domains of behavior: Cognition and Emotion. Certain facts are, however, overlooked in the debate.

Firstly, there are very often chains of reactions: A situation may give rise to emotions, but these will often produce verbal or cognitive reactions, or direct action, sometimes irrelevant to the situation - "letting off steam". Some basic types of chain are (a) perception - emotion - thinking/action; (b) emotion - thinking/action; (c) emotion - perception - thinking/action; (d) emotion - action; (e) emotion - thinking; (f) perception - thinking - action - emotion. The scope and emphasis of the components may vary, within and between chains. It is difficult to say what is primary in an example where there is an initial, swift and vague perception, an instantaneous, strong emotion followed by action and cognition, such as being scared and running away from what turns out to be an illusion or misperception.

Secondly, regarding relative independence, our results on the group/ individual level strongly agree with the position of Zajonc (1980, 1984) that affection and cognition may be relatively independent on the systems level. It is necessary to examine the opposite view to see what may be wrong. Much of Lazarus' argumentation is built on four assumptions: (a) that emotions cannot give rise to perceptions or cognition; (b) that perception/cognition always precedes emotion; (c) that perception cannot be parallel to, or simultaneous with emotion; (d) that perception is part of the cognitive domain. We will later examine some evidence that will throw light on Lazarus' position, demonstrating that all these assumptions are untenable in the light of recent neuropsychological research.

Thirdly, if behavior and brain mechanisms shall at all be looked at differentially, the division into two realms of behavior only is untenable. We will have to differentiate between at least four major domains of behavior: perception, cognition, action and emotion. These domains have so distinctive features, behaviorally and neurologically, that combining any of them is a gross over-simplification. Much of the disagreement may partly be dissolved if we perception is taken out of the cognitive domain. There are extremely strong reasons for such a step.

Fourth, asking ourselves what cognition really is, we must further delimit cognition to mean higher processes (thinking, language, imagery, fantasy, logical operations etc.).

Perception should be regarded as a basic, independent process, as a domain by itself, as Gibson's ecological theory of perception (1979) predicts. Any living being should be

regarded as a perceptual system in his entirety. Walking moving, turning the head, pricking the ears, directing the eyes, etc. all interact. Thus, perception is much more than just seeing, hearing, smelling, etc. All living organisms are perceptually adapted to their environment. For instance, we do not see in a simple, optical way. What we see is very different from what we obtain in a photograph. This adaptation is built-in into the perceptual system, in form of the columnar build-up of the cerebral cortex (see below). Thus, perception has a very strong hereditary component, which in many cases make learning or cognitive analysis superfluous. Gibson (1979) points out that there is often enough information in what is being perceived without a need for subsequent cognitive analysis in order to interpret what has been perceived. Further, one might ask what is cognitive in the perception of hunger, thirst, pain, and the proprioceptive and kinetic senses. A hungry individual eats, i. e. acts without cognitive consideration. Even a newborn baby sucks when hungry and offered a nipple, due to direct reflex paths. It seems, mildly put, exaggerated to regard such reflex action as cognition.

Regarding perception as a separate domain is borne out by what is now known about the brain's way of functioning. Especially the findings of the columnar system of the brain are of interest. This system was explored by Nobel Prize winners D. Hubel and T. Wiesel in numerous experiments, and integrated into a theory for higher mental functioning by Edelman & Mountcastle (1978). In the primary sensory projection areas, particular columns process details in a highly specialized fashion. As shown by Mishkin and his coworkers (Mishkin & Appenzeller, 1987), stations on increasingly higher levels perceive and interpret larger more complex and more total configurations. There is a continuous development from sensation to concept. It seems a misuse of the term cognition to regard early stages of sensation and perception as cognition. It is also now shown, as Zajonc assumes, that simple sensations, and perceptions at an early stage in the chain may directly affect emotional centra and release emotional responses. A number of higher and more analytical mental processes may be bypassed, as it were.

Anatomically and physiologically, cognition and affection are processed by different systems. Higher mental functions are processed in the cerebral cortex, although some primitive cognitive functions, for instance language functions, are processed in the thalamus. Emotions are processed by the Autonomic Nervous System (ANS), with headquarters in the Hypothalamus, by the Limbic System, primarily the Hippocampus and the Amygdala, and to some extent by the Reticular Activation System (RAS) and the Thalamus. The mechanisms of interaction between affective centra and the cognitive parts of the brain has been thoroughly researched and discussed by the Mishkin group (Mishkin and Appenzeller, 1987). In addition, Zajonc (1980) suggests a further integrative mechanism, the locus coeruleus which is capable of very fast responding and also in other ways is ideally suited for partially independent processing.

Sokolov (1963), carefully studied the physiological events involved in perception. When a stimulus is received via the

sense organs, a number of simultaneous events occur, in the brain, or mediated by the brain. If a subject is exposed to a change in conditions, such as a change in sound or light, the incoming nerve impulses from the sense organs accomplish suppression of alpha rhythms in the brain, as well as changes in blood pressure, heart rate, pupil size, peripheral and central vaso-constriction dilution/, change of skin temperature, etc., i. e. being part of arousal. Arousal is a reaction, physiologically preparing the body for action, involving the same type of physiological reactions as in emotions. The arousal may also be simultaneously accompanied by emotion. These changes are brought about via the ANS, which has direct fibres to the cerebral cortex. The changes take place immediately, even before the subject becomes conscious about the change in conditions. When the conditions are stabilized, these effects disappear, to reappear at even slight changes in conditions. Thus, sensory and affective events take place simultaneously, and any cognitive deliberation will take some time.

Mishkin & Appenzeller (1987) have followed the brain's processing of sensory events, from the primary reception areas to higher stations where concepts are being formed. In the primary sensory projection areas, particular neural columns process details in a highly specialized fashion. Columns in stations on increasingly higher levels perceive and interpret more complex and more total configurations (ibid.) There is a continuous development from sensation to concept. Central for laying down memories are the amygdala and hippocampus in the limbic system, which can substitute for each other regarding features of objects, whereas the hippocampus processes spatial relations between objects. The amygdala has direct, extensive connections with all the sensory cortical systems. It also has direct fiber connections with the hypothalamus, the source of emotional responses. "It is possible that the amygdala not only enables sensory events to develop emotional associations, but also enables emotions to shape perception and the storage of memories." (ibid., p. 70). "Together, the evidence suggests the possibility that opiate-containing fibers run from the amygdala to the sensory systems, where they may serve a gate-keeping function by releasing opiates in response to emotional states generated in the hypothalamus. In that way the amygdala may enable the emotions to influence what is perceived and learned." (ibid., p. 70).

Thus, Lazarus' four assumptions are invalid: emotions can give rise to perceptions or cognition; perception/cognition need not always precede emotion; perception may well be parallel to, or simultaneous with emotion; sensation and at least the early stages of perception should not be regarded as part of the cognitive domain. But even more positive proof for emotions inducing and structuring cognition can be found.

7.9 Endocrine Regulators of Affective Behavior Inducing Cognitive Processes

If clear instances can be found of emotions being primary to cognition, i. e. structuring and determining the type and mode of cognition, the hard-line stance of Lazarus and other cogni-

tivists would ultimately be untenable. And, indeed, there are such instances. As is common text book knowledge, endocrine functions play a major role in regulating emotions. Among many existing examples, a few only have been selected. They are (a) melatonin-induced depression, (b) gonado-hormonal influences on behavior, (c) thyroid-deficiency-induced anxiety, and (d) differential effects of arousal-inducing hormones. The reader is referred to Netter (1965a, b; 1967) whose medical illustrations are unsurpassed in giving the anatomical, physiological, and functional (often including psychological) characteristics of the nervous, endocrine and reproductive systems.

Certain kinds of depression may be induced or increased through melatonin, one of the hormones produced by the pineal gland (Netter, 1965b). The pineal gland also produces hormones (cortisoids and stereoids) that are known as "stress hormones". The pineal gland is light sensitive, and receives direct connections from the eyes. During the light hours, and especially during the light seasons, more of the "stress" hormones are produced, inducing activity and alertness. During dark hours and seasons, melatonin is produced, causing sleepiness, and sometimes depression in patients sensitive to light variations.

These types of depression are now cured through light therapy, i.e. patients are subjected to light of a light temperature of about 5,000 degrees Kelvin, a couple of hours 2-3 times a week (S:t Göran's Hospital in Stockholm, personal communication). The outlook and conclusions about the world, i. e. the cognitive processing, is structured by the hormonal activity, giving rise to the feeling of depression. It is difficult to conceive of any cognitive activity that would affect the hormonal production, especially in a differential way so that some are affected but not others.

The gonadotropic or "sex" hormones affect behavior, not only sexually, but in a variety of ways. The adenohypophysis, or fronterior lobe of the hypophysis, secretes at least six so-called tropic hormones of protein or peptide compound, (Netter, 1965a). Three of these hormones are concerned with gonadal function, viz. the FSH (Follicle Stimulating Hormone), the LTH (Luteotropin or Prolactin), and the LH (Luteinizing Hormone) which is identical with the ICSH (Interstial-Cell-Stimulating Hormone) in the male. The ratio of these hormones vary with age, workload, stress, and in women, with the menstrual cycle. FSH stimulates the first part of this cycle, and LH stimulates ovulation and other processes. LH controls the production of estrogen and progesterone, the latter becoming elaborated just before ovulation. Prolactin is present during the later part of the menstrual cycle.In the male, testosterone provides the sex urge or libido.

Female affective behavior, as well as sexual urge, changes during the menstrual cycle. Some days before menstruation, the Premenstrual Stress Syndrome (PMS) in many females causes tension and irritability. From menstruation till about the time of ovulation, the sexual urge is highest, and then diminishes. The emotional reactions (affection, joy, anger, irritation, etc.) to similar events may be very different before and after ovulation. Male sexual and parasexual interest and

behavior, as well as the evaluation of the opposite sex, changes with the level of testosterone in the blood.

Sexual interest is normally accompanied by feelings of tenderness, care, etc., as expressed in works of fiction: "Love and love's fruit - compassion, concern, pity, generosity" (Wicker, 1985, p. 535). When a person in love writes love poems or love letters, it is the feelings that structure the cognitive efforts, and not vice versa.

A third example of physiological effects on emotions is thyroid disturbances, which may cause nervousness and anxiety (Netter, 1965b), similar to what may also be caused by troublesome external conditions. Again, in the case of thyroid disturbance, the feelings are there first, and cognitive reactions are induced by them.

Finally, the pituitary gland produces the hormone ACTH which triggers the production of adrenaline and noradrenaline in the suprarenal glands (Netter, 1967). Adrenaline is instrumental in arousal processes such as anger, fear, joy, general arousal, etc. The suprarenal glands are also innervated by the ANS, so that the hypophysis, or pituitary gland, exerts a dual effect on the suprarenal glands. Some persons will have a balanced temperament, not being easily aroused. Other persons, e. g. the choleric types, will react quickly, very strongly, and perhaps very differently to the same events. The cognitivist view is unable to explain such differential reactions.

In the examples given above, hormonal effects, via emotions, structure cognition, not vice versa. There are also other, complex problems of partly emotional, partly cognitive nature in interaction, as in the case of anorexia nervosa, where an identity conflict leads to self-starvation that in turn will affect gonadal and other hormone production, that will in turn affect cognition (cf. the discussion on behavioral chains above). Thus the picture is much more multi-faceted and nuanced than the cognitivist view will lead us to believe. As shown by our examples, hormonal-affective influences on cognition are frequent events, of an every-day nature, at variance with the views of the cognitivists. The cognitivist idea of "propositional attitudes", i. e. evaluative judgments as basic to emotions, appears oversimplified , reductionistic and rigid in relation to the rich and complex nature of feelings as well of cognitive processes, and their interplay.

7.10 Conclusions

The multivariate analyses presented are an attempt to test theories of the relations between affection, language and cognition in a quantitative manner. The over-all pattern is clear enough: in combinations of language by reading, reading by intelligence and language by intelligence, Rc increases substantially in comparison to r. In contrast, this increase is very slight in all combinations with affection.

Perceptual, neural and endocrine data strongly suggest that emotions can give rise to perceptions and/or cognition; that perception and/or cognition do not always precedes emotion;

that perception as well as cognition can be parallel to, or simultaneous with emotion; (d) that perception is a separate domain, partly overlapping with the cognitive domain. Thus, applying results from various areas, adjacent to psychology, we find a strong support for the relative independence of perception, cognition, and emotion, further explaining why systematic correlations between affective and cognitive data cannot be expected. Our results strongly supports Zajonc's position and rejects the cognitivist position. The latter thus cannot support the hypotheses of language, or even cognitive, primacy over social and emotional development in bilingualism in particular, and in monolingual development in general.

Neither empirical data on direct measurements of the relationships between language, cognition and affection in bilingualism or in general, nor perceptual, neural and endocrine data support the idea of language inducing or curing affective, social or cognitive deficits.

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Table 5. The language by adjustment domains, harsher statistical demands

Statistical demands: Variables 1-4 n ▸ 3 5, 6 n ▸ 1 19-22 n ▸ 3				N = 197	
Canonical Rc	% variance in common between sets	X2	df	p	Roots removed
.41	16.7	53.03	24	p<.01	0
.26	6.7	18.26	15	-	1

Table 6. Factor structures for left and right sets (first canonical factor only), total variance extracted from each set, and total redundancy for each set, given the other. Language by adjustment domains, severe demands.

Left set		Right set	
Variables	Factor load.		Factor load.
5. Listening comp.	.76	1. Progress in sch.	.95
6. Reading compreh.	.55	2. Social adjustmen.	.58
19. Dictation	.63	3. Emotional adjust.	.46
20. Free written prod	.88	4. Progress in Swed.	.77
21. Pronunciation	.73		
22. Free oral produc.	.75		
Total var. extracted from left set	78%	Tot. var. extracted from right s.	100%
Total redundancy for left set	9.7%	Tot. redundancy for right set	9.9%

Table 7. The reading by adjustment domains

Statistical demands: variables 1-4 n ▸ 3 7-15 n ▸ 6				N = 1,017	
Canoncial R	% variance in common between sets	X2	df	p	Roots removed
.25	6.4	96.53	36	p<.01	0
.12	1.4	29.52	24	p<.20	1

Table 8. Factor structures for reading by adjustment domains.

Left set		Right set	
Variables	Factor load.		Factor load.
7. RLS 1 Time	-.28	1. Progress in sch.	.82
8. RLS 1 Words	.49	2. Social adjustmen.	.55
9. RLS 1 Errors	-.82	3. Emotional adjust.	.49
10. RLS 2 Time	-.45	4. Progress in Swed.	.91
11. RLS 2 Words	.35		
12. RLS 2 Errors	-.83		
13. RLS 3 Time	-.56		
14. RLS 3 Words	.53		
15. RLS 3 Errors	-.85		
Total var. extracted from left set	66%	Tot. var. extracted from right s.	100%
Total redundancy for left set	2.7%	Tot. redundancy for right set	3.7%

Table 9. The intelligence by adjustment domains

Statistical demands: variables 1-4 n ⩾ 3 N = 210
16-18 n ⩾ 2

Canoncial R	% variance in common between sets	X2.	df	p	Roots removed
.24	5.9	17.11	12	p<.20	0

Table 10 Factor structures for intelligence by adjustment domains.

Left set		Right set	
Variables	Factor load.		Factor load.
16. DBA 4. R factor	.71	1. Progress in sch.	.54
17. DBA 7. S factor.	.85	2. Social adjustmen.	.59
18. DBA 8. N factor	.56	3. Emotional adjust.	.19
		4. Progress in Swed.	.91
Table 10 (continued)			
Total var. extracted from left set	100%	Tot. var. extracted from right s.	100%
Total redundancy for left set	3.6%	Tot. redundancy for right set	2.5%

Table 11. Oral reading by language domains

Statistical demands: variables 1-4 n ⩾ 6 5-6 n ⩾ 1		N = 253			
Canoncial R	% variance in common between sets	X2	df	p	Roots removed
.78	61.3	296.93	54	p<.001	0
.31	9.4	65.35	40	p<.01	1
.29	8.4	41.20	28	.10>p<.05	2
.21	4.5	19.82	18	-	3

Table 12. Factor structures for reading by language domains.

Left set		Right set	
Variables	Factor load.		Factor load.
7. RLS 1 Time	-.56	5. Listen. Compreh.	.57
8. RLS 1 Words	.58	6. Reading Compreh.	.88
9. RLS 1 Errors	-.77	19. Dictation	.93
10. RLS 2 Time	-.45	20. Free writt. prod.	.79
11. RLS 2 Words	.35	21. Pronunciation	.64
12. RLS 2 Errors	-.83	22. Free oral prod.	.48
13. RLS 3 Time	-.56		
14. RLS 3 Words	.53		
15. RLS 3 Errors	-.85		
Total var. extracted from left set	81%	Tot. var. extracted from right s.	100%
Total redundancy for left set	3.2%	Tot. redundancy for right set	3.6%

Table 13. Oral reading by non-verbal intelligence

Statistical demands: variables 7-15 n ⩾ 6 19-20 N ⩾ 3		N = 260			
Canoncial R	% variance in common between sets	X2	df	p	Roots removed
.46	20.8	71.64	27	p<.001	0
.18	3.4	12.62	16	-	1

Table 14. Factor structures for reading by intelligence domains.

Left set		Right set	
Variables	Factor load.		Factor load.

7. RLS 1 Time	-.46	16. DBA 4. R factor	.70
8. RLS 1 Words	.50	17. DBA 7. S factor	.80
9. RLS 1 Errors	-.59	18. DBA 8. N factor	.70
10. RLS 2 Time	-.27		
11. RLS 2 Words	.14		
12. RLS 2 Errors	-.68		
13. RLS 3 Time	-.62		
14. RLS 3 Words	.43		
15. RLS 3 Errors	-.89		
Total var. extracted from left set	46%	Tot. var. extracted from right s.	100%
Total redundancy for left set	6.6%	Tot. redundancy for right set	12.4%

Table 15. Language by nonverbal intelligence

Statistical demands: variables 5-6 n ⩾ 1 N = 50
19-20 n ⩾ 3
16-18 n ⩾ 2

Canoncial R	% variance in common between sets	X2	df	p	Roots removed
.69	48.2	38.11	18	p<.01	0
.36	13.0	9.14	10	-	1

Table 16. Factor structures language by non-verbal intelligence.

Left set		Right set	
Variables	Factor load.		Factor load.
5. Listening comp.	.54	16. DBA 4. R factor	.69
6. Reading compreh.	.86	17. DBA 7. S factor	.92
19. Dictation	.72	18. DBA 8. N factor	.70
20. Free written prod	.54		
21. Pronunciation	.28		
22. Free oral produc.	.22		
Total var. extracted from left set	68%	Tot. var. extracted from right s.	100%
Total redundancy for left set	19.1%	Tot. redundancy for right set	32.9%

Table 17. Reduced language domain by intelligence domain

tatistical demands: variables 5, 6, 19, 20 n ⩾ 3 N = 263 16-18 n ⩾ 2					
Canoncial R	% variance in common between sets	X2	df	p	Roots removed
.56	30.8	95.62	12	p<.01	0
.05	.2	.59	6	-	1

Table 18. Factor structure for language by non-verbal intelligence.

Left set		Right set	
Variables	Factor load.		Factor load.
5. Listening comp.	.54	1. DBA 4. R factor	.69
6. Reading compreh.	.87	2. DBA 7. S factor	.92
19. Dictation	.90	3. DBA 8. N factor	.70
20. Free written prod	.79		
Total var. extracted from left set	83%	Tot. var. extracted from right s.	100%
Total redundancy for left set	19.1%	Tot. redundancy for right set	16.3%

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Abstract card

Ekstrand, L.H. The relation between language, affection, and cognition in bilingualism: Quantitative assessments of the interrelationships. Educational and Psychological Interactions (University of Lund - Malmö School of Education), No. 113, 1992.

Assumptions of strong, causal relations between cognition, language and affection are often made, in bilingualism and in general. A first set of hypotheses concerns the relation between affection and language in bilingualism. One subset is concerned with language learning, language maintenance, and mental health in migrant children, another with the critical period theory for language learning. A second set of assumptions is concerned with the relation between affection and cognition in general. A third set of hypotheses is concerned with the relationship between language and cognition. Research and statements regarding the three sets are reviewed.

Keywords: Acculturation, affective development, adjustment, bilingual education, bilingualism, child development, cognitive development, cross-cultural research, emotion and cognition, emotional development, endocrinological development, immigrants, language and cognition, language development, psycho-linguistics, second language learning.

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